MICHELLE MAHER
NCI/DCPC
6006 Executive Blvd. Suite 321 MSC7058
ROCKVILLE, MD 20892-7058

ATTN:
PHONE: 301-496-0478
FAX: 301-435-8645
E-MAIL:

TITLE: PAEDIATRIC AND PERINATAL EPIDEMIOLOGY
PUBLISHER/PLACE: Blackwell Scientific Publications Oxford
VOLUME/ISSUE/PAGES: 1991 Oct;5(4):428-44 428-444
DATE: 1991
AUTHOR OF ARTICLE: Naggan L; Forman MR; Sarov B; Lewando-Hundt G; Zangwill L; C
TITLE OF ARTICLE: The Bedouin Infant Feeding Study: study design and factors i
ISSN: 0269-5022
OTHER NOS/LETTERS: Library reports holding volume or year
8709766
1754502
SOURCE: PubMed
CALL NUMBER: W1 PE163HN
NOTES: Please email all copy orders

Paediatric and Perinatal Epidemiology 1991, **5**, 428–444

The Bedouin Infant Feeding Study: study design and factors influencing the duration of breast feeding

Lechaim Naggan*, Michele R. Formant, Batia Sarov*, Gillian Lewando-Hundt*, Linda Zangwill*, David Chang‡ and Heinz W. Berendes‡

**Center for Health Sciences, Ben Gurion University of the Negev, Beer Sheva, Israel, †Cancer Prevention Studies Branch, CPRP, DCPC, National Cancer Institute, Bethesda, and ‡Prevention Research Program, National Institute of Child Health and Human Development, Bethesda, Maryland, USA*

Summary. A longitudinal study of infant feeding practices, growth and morbidity among Bedouin Arab infants residing in the Negev, Israel, was conducted during a 3-year period (1981–1983). Follow-up samples were restricted to healthy newborns. The majority of newborns are breast fed at birth but, by 2 months, 50% are also introduced to a milk supplement. Based on the bivariate analysis using the logrank test to examine the factors associated with exclusive versus partial breast feeding during the first 6 months, those born during the wet cool months are exclusively breast fed longer than those born during the dry season. More traditional women, living in tents rather than houses or huts, exclusively breast feed for at least 6 months. In a multiple logistic regression model, parity, house type and birth season are independently associated with the odds of exclusively breast feeding for the first 6 months of life. Factors influencing the duration of any breast feeding for the first 18 months include: house type, place of residence, birthweight, and whether the infant was stunted at 6 months.

Address for correspondence: Dr L. Naggan, Epidemiology Unit, Ben Gurion University of the Negev, POB 653, Beer Sheva 84105, Israel.

Introduction

The Bedouin Arabs live in the Negev, a semi-arid area comprising the southern two-thirds of Israel. Like most Bedouin Arabs in the Middle East, they are in transition from semi-nomadism to a settled way of life.[1,2] As semi-nomads, they herded sheep and goats and grew winter crops of wheat and barley. Over the past 25 years, the available land for herding has decreased in line with agricultural and industrial development across the Negev. Therefore, since the 1960s an increasing number of Negev Bedouin Arabs have been working as wage labourers, which has supplemented and increasingly replaced herding as a means of livelihood.

Today, Negev Bedouin Arabs live either in planned urban settlements (established), unplanned residential clusters (transitional) or in temporary encampments (traditional). Settlement choice is based on a number of factors. Since families live in subtribal units, both in planned and unplanned neighbourhoods, the choice reflects subtribal rather than an individual family's economic resources and preferences.[3,4] The planned settlements have an infrastructure of roads, sewage disposal, water and electricity, schools, clinics and shops. Unplanned settlements have less access to schools and clinics and almost no running water or electricity. In both, planned and unplanned settlements, Bedouin Arabs live in a variety of dwellings; tents, huts and houses, the latter of which predominate in the planned settlements.

Preventive maternal and child health (MCH) services are available free of charge at permanent clinics or through a mobile MCH van. The Soroka Medical Center, which is affiliated with the Ben Gurion University (BGU) and is located in Beer Sheva, is the hospital used by the entire Negev population. Bedouin Arab mothers and children use the obstetric and paediatric wards. On average, 53% of the paediatric beds in the Soroka Medical Center are occupied by Bedouins, who make up 30% of the paediatric population.

Objectives

During the period of planned settlement, a longitudinal cohort study of infant feeding practices, growth and morbidity was conducted (1981–1983) among the Bedouin Arabs in the Negev. The objectives of this study were:

(1) To document changes in infant feeding practices over time by collecting infant feeding histories of children both before and during settlement.
(2) To examine the association between feeding practices, growth and morbidity among a cohort followed until 18 months of age.
(3) To compare retrospectively collected with concurrently collected infant feeding data in order to test the reliability of maternal-reported infant feeding practices.

(4) To document health service use by a population in transition.

The purposes of this paper are: to describe the study design and methods; to describe infant feeding practices during the first 18 months of life in a population undergoing rapid urbanisation; and to determine the factors influencing the duration of breast feeding (with/without milk and solid supplementation) before and after adjustment for covariates. Therefore, this paper describes the methodology of the entire study but describes and discusses the results of the first objective only.

Methods

The study population included all Bedouin Arab women ($n = 4623$) who delivered newborns in hospital or at home in the Negev during 1981 and 1982. All births were ascertained from three sources: hospital births registry, birth registry of the census bureau and special lists maintained by the tribal chiefs. A block sampling method was used to permit follow-up of different samples. We decided, for practical reasons, to take block samples of consecutive births of healthy newborns, excluding: multiple births; newborns who weighed < 2200 g or had congenital anomalies or were hospitalised for more than 10 days; and early neonatal deaths. By excluding these mother–infant pairs, we tested the effect of social change on infant feeding practices, growth and morbidity among a sample of mothers with healthy babies.

During the months of recruitment in 1981 (mid-January to March, May and July to mid-October), for example, 1241 babies were born. From these, 1042 were eligible for the study; however, only 945 of the mothers were selected for the interview (90.7%). The reason for excluding 9.3% was mostly due to the tight interviewing schedule. Those not interviewed were chosen randomly.

The schedule of interviews among samples of this healthy population, unless otherwise identified, was as follows (Figure 1):

(1) In 1981, initial interviews were administered to two samples of mothers with infants at approximately 6 months of age. Sample IA ($n = 539$) was selected from births during January through to May excluding those born during April. Interviews were halted during the Jewish High Holidays in September to October when the children born in April would have been 6 months of age. Sample IB ($n = 406$) was selected from births during July through to October 1981. The following data were collected at these interviews: infant feeding practices from birth to 6 months; social and physical environmental factors potentially influencing infant feeding practices and health; use of health services; anthropometrics and recall of minor morbidity since birth.

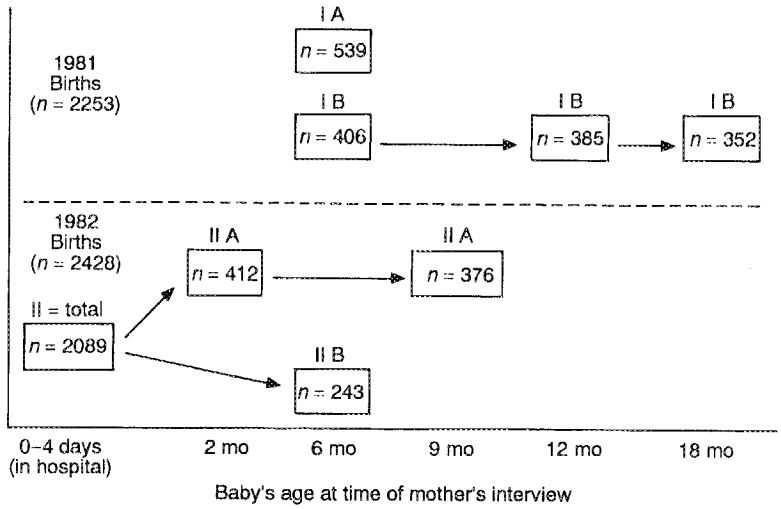

Figure 1. Bedouin Infant Feeding Study: samples' interview schedule.

(2) Sample IB was reinterviewed at 12 and 18 months ($n = 385$ at 12 and 352 at 18 months) with infant feeding, anthropometrics and morbidity data collected to determine the relationship between weaning, growth and morbidity.

(3) In 1982, birth interviews were either administered at the hospital 1–3 days after hospital delivery or administered at home within 2 weeks of the home birth ($n = 73$): total interviewed – $n = 2089/2428$. Three hundred and thirty-nine babies were either excluded from the follow-up study because of exclusion criteria or were missed at the hospital. The reasons for exclusion were as follows: low birthweight – 187 (7.7% less than 2200 g), twins – 73 (3.0%), birth defects – 10 (0.4%), neonatal deaths – 22 (0.9%), hospitalisation beyond 10 days after birth – 36 (1.5%) and 11 (0.5%) were missed either in the hospital or at home. Information about prenatal conditions and care as well as current and intended infant feeding practices was collected.

(4) From among all births in 1982, two samples of mother–infant pairs were followed. Sample IIA ($n = 412$) was reinterviewed at 2 months to examine factors influencing changes in infant feeding practices following the traditional 40 days of postpartum rest.[5] This sample was reinterviewed at 9 months ($n = 376/412$) at which time growth, infant feeding and morbidity data were collected. Sample IIB ($n = 243$) was reinterviewed at 6 months when similar data to that collected at 6 months in the 1981 samples were collected.

(5) Whenever possible, special interviews were conducted with mothers of infants during hospitalisation or at home soon after hospital discharge to

obtain data on infant feeding practices before, during and following hospitalisation.

Obstetric, neonatal, paediatric and infant death records for the first year of life were abstracted for the total population by trained BGU medical students. These clinical and vital statistics data were collected to complement the interview data.

Sampling validity

The representativeness of the mothers interviewed in 1981 was examined by comparison with those not interviewed in 1981, applying the same exclusion criteria (Table 1). The two samples born in 1981 (IA and IB) had similar distributions of major demographic covariates and were therefore combined. The distributions of maternal age, birthweight, parity and place of residence did not differ among the combined sample and the non-interviewed; therefore, these samples have external validity. Place of residence data were unavailable for the non-interviewed population in 1981 and therefore data based on all 1982 birth interviews were used for comparison.

The two samples which were followed from the 1982 birth cohort were

Table 1. Comparison of samples of cohort 1981 with non-interviewed population (1981) by maternal age, birthweight, parity and place of residence*

Variables	Interviewed samples *n*	Non-interviewed population *n*	Test results	*P*-value
Maternal age (mean ± s.e.)	27.99 yr (± 0.22)	27.80 (± 0.20)	$F = 1.00$	$P > 0.9$
Birthweight (mean ± s.e.)	3193.9 g (± 14.5)	3123.2 g (± 13.5)	$F = 1.09$	$P > 0.20$
Parity				
0	139 (14.9%)	160 (12.1%)		
1	115 (12.3%)	157 (11.9%)		
2–3	191 (20.4%)	287 (21.8%)		
4–6	242 (25.9%)	357 (27.1%)		
7+	247 (26.4%)	358 (27.1%)		
Total	934 (100%)	1319 (100%)	$\chi^2 = 3.9$	$P > 0.60$
Place of residence				
Established	312 (34.5%)	690 (35.3%)		
Transitional	245 (27.1%)	577 (29.5%)		
Traditional	346 (38.3%)	689 (35.2%)		
Total	903 (100%)	*1956 (100%)	$\chi^2 = 2.9$	$P > 0.40$

* Comparison group for type of residence only is total population of cohort 1982 (see text).

Table 2. Comparison of samples of cohort 1982 with non-interviewed population (1982) by maternal age, birthweight, parity and place of residence

Variables	Sample IIA *n*	Sample IIB *n*	Non-sampled population *n*	Test results	*P*-value
Maternal age	28.49 yr	27.35 yr	27.53 yr	$F = 1.21$	$P < 0.03$
Birthweight	3189.3 g	3129.5 g	3168.6 g	$F = 0.36$	$P > 0.70$
Parity					
0	43 (10.8%)	23 (9.9%)	249 (17.4%)		
1	36 (9.0%)	25 (10.8%)	183 (12.8%)		
2–3	100 (25.1%)	69 (29.8%)	313 (21.9%)		
4–6	98 (24.6%)	58 (25.0%)	364 (25.5%)		
7+	122 (30.6%)	57 (24.6%)	318 (22.3%)	$\chi^2 = 32.9$	$P < 0.0001$
Total	399 (100%)	232 (100%)	1427 (100%)		
Place of residence					
Established	170 (41.8%)	93 (39.7%)	427 (32.5%)		
Transitional	133 (32.7%)	65 (27.8%)	379 (28.8%)		
Traditional	104 (25.6%)	76 (32.5%)	509 (38.7%)		
Total	407 (100%)	234 (100%)	1315 (100%)	$\chi^2 = 36.8$	$P < 0.0001$

selected for the purposes described in the interview schedule. The samples differed from the non-sampled population by place of residence (Table 2). The pressures of interviewing several cohorts in 1982 and of completing the interviews by 1983 led to a higher proportion of interviewing in the 'established' towns than in 'traditional', more isolated residential areas.

Significantly fewer primiparae were interviewed in 1982 compared with the non-interviewed population (10% vs. 17%, interviewed vs. non-interviewed; $P < 0.01$) (Table 2). During the hospital birth interview, the mother was asked to describe the location of her home for potential follow-up. Although no one refused to be followed, a certain proportion of women gave insufficient information for location of their homes by the drivers. These women were younger, of lower parity, and may have been second wives. Polygamy is accepted by Bedouin Arab custom and Moslem religious law and is practised by a proportion of Bedouin Arabs. Although this practice is discouraged by Israeli society, it is tolerated with due respect. When parity was adjusted for different proportions of second wives, the above differences by parity and maternal age disappeared. Therefore, it seems probable that some second wives may not have wanted a follow-up home visit to prevent disclosure of their co-wife status.[6]

Questionnaire development and field team training

The questionnaires were constructed by a nutritional epidemiologist (M.R.F.), an epidemiologist (B.S.) and an anthropologist (G.L.-H.). The questionnaire sought

information relating to infant feeding practices and growth, maternal reproductive history, health service utilization, and the socio-economic circumstances of the household. The questionnaires were pretested in a pilot study ($n = 143$). Examples of questions asked relating to feeding practices were as follows:

How are you feeding your baby now?
(1) Breast feeding only: (a) without other liquids
(b) with other liquids (tea, juice)
(2) Breast feeding and supplement
– types of supplement
(3) Does not breast feed and is nourished by: milk, formula, solids, etc.

The number of times per day and night of breast or bottle feeding was also recorded.

A list of foods was also read to the mother, who was asked at what age the child first ate that particular food and whether she gave that food to the baby in the last 24 hours. In addition, the questionnaire contained more detailed questions on feeding and plans for feeding (both past and future).

At each interview, weight, length, head and arm circumferences, biceps and scapular-skinfolds were measured by trained interviewers. Salter scales, Harpenden calipers and WHO measuring boards were regularly tested. Interviewers were trained at baseline in anthropometric data collection, checked monthly, with intra- and inter-observer variability measured at several intervals.[7]

The field team consisted of 13 female Arab (BGU) student interviewers and two drivers. Two interviewers specialised in hospital birth and morbidity interviews, while the others administered home interviews. All interviewers were trained and supervised by a social anthropologist (G.L.-H.). The interviewers were coached in Negev Bedouin Arabic, and had weekly meetings to exchange information and consult on problems. All questionnaires were checked by another interviewer on the day of the interview and subsequently, at random, by the supervisory staff. Although the questionnaires were originally designed for a one-to-one interview, the social milieu of the home environment was not conducive to individual discussion. Only 7% of the interviews were one-to-one, while 23% also had children present, 49% had children and other women present and the remaining 21% had a mix of groups present.

The response rate for home or hospital interviews was high with only one refusal for a home interview. The high response rate was due to the concern of Bedouin Arab women for their children's health and traditional hospitality among Bedouin Arabs. The attrition rate of the follow-up samples was: 5% from the 6 to the 12 months interview and another 9% from the 12 to the 18 months interviews of sample IB; and 9% between the 1982 interviews at 2 and 9 months of sample IIA.

Attrition was due to difficulties in locating the more mobile members of this population or to the child's death.

Data analysis

In order to examine infant feeding patterns over time, maternal-reported feeding practices at each interview were categorised as follows: the exclusively breast fed included a large proportion of infants with intake of tea, juice or water. The breast and supplement fed received either milk, formula, and/or cereal. The weaned were fed milk/formula from a bottle or other utensil with or without solids. If a change in category occurred only temporarily, for a day or two and then discontinued, the child was categorised to his previous 'main' group.

The analysis is separated into two phases. All analyses were conducted on the samples from each cohort excluding the missing or low birthweight (2200 to 2499 g). The total numbers for each sample are: 476/539 in sample IA; 384/406 in sample IB at 6 months; 388/412 in the 2-month interview of sample IIA; 224/243 in the 6-month interview of sample IIB. These samples were combined for the analyses when age-specific infant feeding data were available.

In the first phase, the distribution of infant feeding practices were examined by the infant's age, type of residence, housing type, parity and maternal age. Based on the results of these single factor analyses, the variables significantly associated with the duration of exclusive breast feeding based on the logrank test were entered into two multiple variable models in the second phase.[8] Multiple linear and logistic regression analyses were used to model the duration of breast feeding.[9,10]

The outcome variables for the multiple logistic regression models were exclusive breast feeding for at least 6 months compared to those who were exclusively breast fed up to 2 or 4 months, respectively. The cut-offs at 2 and 4 months were selected because the average duration of exclusive breast feeding among the Bedouin Arab women was 2 months, while the American Academy of Pediatrics recommends exclusive breast feeding for 4 to 6 months.[11] The outcome variable for the multiple linear regression model was the average duration of any breast feeding during the first 18 months (including milk and solid supplement). The infants followed for 6 months with complete data ($n = 793/860$) were examined in the multiple logistic regression analysis, while those followed for 18 months with complete data ($n = 248/352$) were examined in the multiple linear regression analysis.

In all models, birthweight was treated continuously while the following variables were treated categorically: marital status; maternal age; parity; infant's birth month, which was an indicator of seasonality; gender; nutritional status classified as stunted (low length for age) vs. normal length for age;[7,12] type of residence; and housing type.

The final models included those variables that remained after stepwise

Table 3. Housing type by place of residence and follow-up cohort

Place of residence	House		Hut		Tent	
	n	%	*n*	%	*n*	%
Traditional ($n = 530$)						
Cohort 1981	36	10	165	48	145	42
Cohort 1982	26	14	108	59	50	27
Transitional ($n = 443$)						
Cohort 1981	32	13	161	66	50	21
Cohort 1982	21	11	149	74	30	15
Established ($n = 579$)						
Cohort 1982	162	52	114	37	36	12
Cohort 1981	171	64	71	27	25	9

backward elimination with a P value of 0.15 to remove and a P value of 0.10 to re-enter. All coefficients were estimated by the maximum likelihood method.[13] The Hosmer chi-square statistic was examined for the goodness of fit of each multiple logistic regression model because most variables were categorical and some had small cells. The multiple logistic regression models were run using the BMDP stepwise logistic regression, while the multiple linear regression models were run using SAS Proc Stepwise.[14,15]

Results

Change in type of housing between the two cohorts indicates one aspect of the general trend of socio-economic change over time in this population. The traditional Bedouins are those living in temporary encampments (mostly in huts and tents), the transitional live in unplanned residential clusters (mostly in huts) and the established ones live in the planned towns (mostly in houses and huts). It can be seen from Table 3 that even during the short period of the study there is mobility within each stratum of place of residence. More traditional Bedouins lived in huts in 1982 rather than in 1981 (59% vs. 48%) and that was also true for transitional Bedouins (74% in 1982 compared to 66% in 1981). Among the established group in the towns, 64% lived in houses in 1982 compared to 52% in 1981.

Almost all Bedouin Arab mothers exclusively breast feed their newborns, with a small percentage adding milk supplement. In the first 6 months of life, there is a sharp decline from exclusive breast feeding (with tea, juice or water) to breast feeding with a supplement of formula or milk (Figure 2). Weaning from the breast is gradual and reaches 13%, 24%, 33% and 50% at age 3, 6, 9 and 13 months respectively (Figure 3).

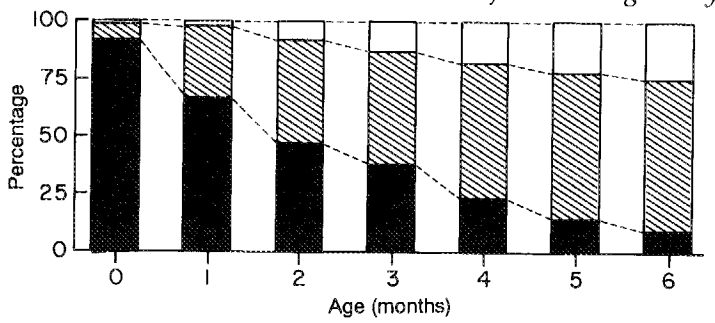

Figure 2. Feeding practices of Bedouin infants from birth to 6 months ($n = 1447$). ■ = exclusively breast fed; ▨ = breast fed and supplement; □ = weaned.

Comparing babies born between January and May (sample IA) to those born between July and October (sample IB), the proportion exclusively breast fed from 1 to 3 months is similar but a significant difference emerges around age 4 months with 29.4% exclusive breast feeders in cohort IA versus only 19.0% in cohort IB (at that point, difference, $\chi^2 = 12.4$, $P < 0.01$). This trend continues until 6 months ($P < 0.001$), when the logrank test is applied to the total 6-month period (outcome event being 'stopped exclusive breast feeding'); the difference remains statistically significant ($P < 0.05$), as shown in Table 4. During the first 2 months of life, more traditional Bedouin Arabs exclusively breast feed than those who are transitional and established, and who are quite similar to each other. After 2 months, the traditional breast feed more than the transitional who in turn breast feed more than the established (Table 4). These differences are statistically significant ($P < 0.01$).

Socio-economic status is closely related to housing type and to the type of residence. There is a strong inverse association between housing type and the percentage breast fed, i.e. the more traditional tent dwellers breast feed

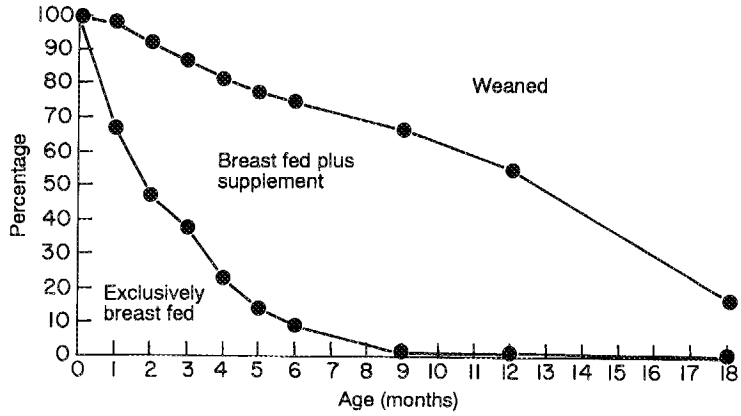

Figure 3. Infant feeding practices: interviewed Bedouins by age (in months) and feeding category ($n = 1447$).

Table 4. Exclusive breast feeding (%) age 1–6 months by season of birth, place of residence, type of housing, parity and maternal age

Variable	Exclusive breast feeding (%) at age			Logrank test (χ^2)	P-value
	2 mo.	4 mo.	6 mo.		
Season of birth					
Born Jan–May '81 (sample IA) ($n = 476$)	50.7	29.4	17.7	4.37 (1 d.f.)	< 0.05
Born Jul–Oct '81 (sample IB) $n = 384$)	49.3	19.0	7.2		
Place of residence ($n = 1273$)					
Established	44.3	19.5	5.9		
Transitional	43.8	22.3	9.7	9.52 (2 d.f.)	< 0.01
Traditional	54.3	29.3	12.9		
Type of housing ($n = 1436$)					
House	39.6	16.9	6.4		
Hut	48.5	23.9	9.1	14.6 (2 d.f.)	< 0.001
Tent	55.6	31.8	13.9		
Parity ($n = 1396$)					
0	61.4	34.7	13.4		
1–2	47.7	21.9	10.1	11.6 (3 d.f.)	< 0.01
3–5	47.9	22.0	8.7		
6+	41.9	20.9	7.3		
Maternal age ($n = 1481$)					
< 20 yr	55.7	29.0	12.6		
20–29 yr	48.3	22.0	9.0	8.0 (2 d.f.)	< 0.02
30+ yr	42.2	22.8	7.8		

Note: The total number for each variable differs because of missing information.

significantly more than the hut dwellers who have a higher rate of breast feeding than the house dwellers (Table 4). There is obviously a strong relationship between type of housing and place of residence, but the relationship is far from complete. For example, only 52% of 'established' Bedouins live in houses while 37% live in huts and 11% still live in tents. Among 'traditional' Bedouins, 38% live in tents, 50% in huts and 12% in houses.

Primiparae (classified as 0 parity) breast feed more than parity 1–5 who breast

feed more than parity 6+ for the first 6 months ($P < 0.01$). Similar to the parity distribution, the frequency of breast feeding is inversely associated with maternal age ($P < 0.02$). When the data were analysed by the proportion of mothers who completely weaned their babies, an approximate 'mirror image' to exclusive breast feeding could be shown for some of the variables (season of birth, type of residence and type of housing); for example, the proportion of babies weaned in samples IA and IB at age 6 months were 21% and 27% respectively. However, multiparous and older women who stop exclusively breast feeding their babies (earlier than the younger primiparae) tend to add a bottle of milk or formula, but continue to breast feed longer than the younger mothers. Thus, at age 6 months, only 17% of the babies of mothers over 36 years have been weaned compared to 28% of babies of young mothers (under 26 years).

Multiple variable models

Marital status, parity and housing type had a significant influence on the odds of exclusive breast feeding for the first 6 months compared to those breast fed up to 2 months (Table 5a). More than second wives, first (or only) wives breast fed for at least 6 months. Multiparae, more than primiparae, were less likely to breast feed

Table 5a. Variables associated with the odds of exclusive breast feeding at 6 months compared to those exclusively breast fed up to 2 months ($n = 793$)*

Variable (comparison group)	*n*	Odds ratio	(95% confidence interval)
Marital status			
(Second wives)	168	1.00	
First or only wives	625	1.47	(1.00–2.16)
Parity			
(0)	120	1.00	
1–2	171	0.39	(0.24–0.65)
3+	502	0.36	(0.22–0.56)
House type			
(House)	213	1.00	
Hut	403	1.65	(1.13–2.39)
Tent	177	2.19	(1.39–3.45)
Place of residence			
(Established)	292	1.00	
Transitional	217	0.806	(0.55–1.18)
Traditional	284	1.29	(0.89–1.87)

* Multiple logistic regression analysis.

for 6 months. Compared to women who lived in houses, women who lived in tents or huts were more likely to continue breast feeding.

In the multiple logistic regression model of exclusive breast feeding for at least 6 months compared to those breast feeding for up to 4 months, birth month, parity and housing type remained in the model (Table 5b). Compared with infants born in January and February, those born in the hot/dry months of May through to October had a significantly reduced odds of breast feeding for at least 6 months. Multiparae were less likely to breast feed for at least 6 months than primiparae. Hut and tent dwellers (compared to house dwellers) were more likely to breast feed for at least 6 months. The same variables remained in a multiple linear regression model with 4% of the variation explained in the average duration of breast feeding for the first 6 months of life.

The variables significantly influencing the average duration of any breast feeding (with or without milk and/or solid supplement) up to 18 months in sample IB included: nutritional status at 6 months, birthweight, housing type and place of residence (Table 6). Stunted infants (low length for age) were kept on the breast longer than infants who were normal length for age at 6 months. Among newborns weighing $\geqslant 2500$ g, the heavier ones tended to be breast fed for longer than those who were lighter. Infants of families residing in tents and huts were more likely to be breast fed for longer than infants residing in houses. Likewise, infants of families living in traditional and transitional encampments were breast fed for longer than infants of families living in settled towns. The variables in this model

Table 5(b). Variables associated with the odds of exclusive breast feeding at 6 months compared to those exclusively breast fed up to 4 months ($n = 793$)*

Variable (comparison group)	*n*	Odds ratio	(95% confidence interval)
Birth month			
(January–February)	192	1.00	
March–April	126	1.04	(0.63–1.70)
May–July	244	0.46	(0.29–0.72)
August–October	231	0.59	(0.38–0.92)
Parity			
(0)	120	1.00	
1–2	171	0.47	(0.28–0.80)
3+	502	0.43	(0.28–0.67)
House type			
(House)	213	1.00	
Hut	403	1.61	(1.04–2.49)
Tent	177	3.12	(1.92–5.06)

* Multiple logistic regression analysis.

Table 6. Variables associated with duration of any breast feeding up to 18 months of age ($n = 228$)*

Variable	Regression coefficient	*P*-value
Birthweight	0.0017	0.06
House type	1.0423	0.07
Place of residence	0.9645	0.03
Stunted at 6 months	3.2713	0.00
Multiple R	0.10	

* Multiple linear regression model.

explained approximately 10% of the variation in the average duration of any breast feeding among the Bedouin Arabs.

Discussion

The Bedouin Arabs of the Negev have experienced dramatic changes over the past 15 years including the study period, as evidenced by the increase in house and hut dwellings and the decrease in tent dwellings. The use of modern health care services has increased as evidenced by a high rate (97%) of hospital deliveries.[16] No studies of infant feeding practices, growth and morbidity have been conducted during this type of natural experiment. Moreover, few studies have examined the factors associated with exclusive breast feeding in contrast with those associated with any/partial breast feeding.[17]

Whereas the majority of Bedouin Arab newborns were breast fed at birth, only 50% were exclusively breast fed at 2 months of age; therefore, we examined the factors influencing the odds of breast feeding for at least 6 months compared to those who breast fed for up to 2 months. Marital status, housing type and parity were significantly associated with the odds ratio of breast feeding for at least 6 months. Compared to second wives, first/only wives are older and may have a more traditional lifestyle including maintaining exclusive breast feeding for at least 6 months. Likewise, hut and tent dwellers compared with house dwellers more often live in traditional encampments with limited access to roads and markets for breast milk substitutes, as well as limited or no electricity and refrigeration for fresh milk. They may have to breast feed for longer durations or, alternatively, they have less need for refrigeration because they breast feed longer.

The very fast change towards a sedentary lifestyle, even during the 2 years of the study, is manifested in the larger proportion of Bedouins who lived in houses in 1982 compared to 1981 (33% and 26% respectively) with the reverse trend in tent dwelling (16% vs. 26% in 1982 and 1981 respectively). Type of housing seems to be the strongest environmental factor which affects the variation of breast

feeding. It is essentially an indicator of urbanisation and, indirectly, of social change, reduced number of children and adaptation to a Western type of society, which partially explains the trend towards shorter breast feeding and a very early supplementation to breast feeding. These findings are in accord with other studies.[18–25]

Parity was negatively associated with breast feeding for 6 months. Since multiparae have closely spaced pregnancies and, with a newborn, still have to care for several other children, this lifestyle might lead to marginal maternal nutritional stores and limited time to maintain exclusive breast feeding. This finding differs from the results of the Malaysian Family Life Survey.[9] The contradictory results may be due to differences in either cultural/ethnic group-specific fertility patterns, or infant feeding patterns, or dietary regimens in the two populations.

Parity, housing type, and birth month (which is an indicator of seasonality) remained in the multiple logistic regression model of breast feeding for at least 6 months compared to those breast feeding for up to 4 months. The findings regarding parity and housing type are similar to the results for the model comparing the odds of breast feeding for 2 versus 6 months. Women who gave birth from May to October faced the hottest months of the year to initiate and maintain breast feeding, notably when monthly mean maximum temperatures range from 31°C to 34°C. There is some evidence that maternal dehydration occurs in the summer months among Bedouin women. The volume of breast milk, however, remains the same but becomes diluted so that breast feeding infants receive enough fluids but may not receive enough nutrients.[26] This phenomenon may contribute to the drop in exclusive breast feeding during this season.

Four variables – housing type, type of residence, birthweight and nutritional status at 6 months – remained in the multiple linear regression model of the average duration of any breast feeding in the first 18 months of life. Women who lived in tents or huts tended to live in traditional and transitional encampments and breast fed longer than women living in houses in settled communities with paved roads and access to health care, schools and markets. Thus, traditional indicators of Bedouin Arab lifestyle vary positively with duration of any breast feeding.[19,24,25]

Compared with infants of normal length for age at 6 months, stunted infants were kept on the breast for longer. The average number of breast feeds per day at 6 and 12 months does not differ significantly. Among infants who were breast and solid fed, the average (and standard deviation) of breast feeds were 9 (3) and 10 (5) times daily at 6 and 12 months, respectively. Among infants who were breast, bottle and solid fed, breast feeds averaged 7 (3) and 8 (4) times daily at 6 and 12 months, respectively. With little or no difference in the extent of breast feeding over time, stunted infants may not have received sufficient energy to maintain adequate growth.[27,28] It must be remembered, however, that all the variables

discussed 'explain' only 4% of the variation of exclusive breast feeding up to 6 months and 10% of the variation of any breast feeding up to 18 months.

In summary, the model of breast feeding for (2 vs.) 6 months includes maternal–environmental factors, while the model for (4 vs.) 6 months suggests a seasonal factor plus several maternal–environmental factors. In contrast, the factors influencing the duration of any breast feeding (up to 18 months for sample IB) are more infant–environment variables. Thus, in early infancy, characteristics of the mother and her environment seem to predict partially the termination of exclusive breast feeding but, with increasing time, the infant and his/her environment may influence slightly the length of breast feeding. This change in the orientation of the model of breast feeding duration away from the mother and toward the infant over time could have some ramifications for the content of breast feeding intervention programmes at different phases of infancy.

Acknowledgements

The authors gratefully acknowledge the support and encouragement of Dr Norman Kretchmar and Dr Shimon Moses in the initiation of this study.

References

1 Chatty, D. *From Camel to Truck: The Bedouin in the Modern World*. New York: Vantage Press, 1986.

2 Salzman, P.C. (ed.) *When Nomads Settle: Processes of Sedentarization as Adaptation and Response*. New York: Praeger Scientific, 1980.

3 Jakubowska, L.A. Urban Bedouin: social change in a settled environment. Unpublished DPhil. New York: State University of New York, 1985.

4 Lewando-Hundt, G.A. Tel Sheva: a planned Bedouin village. In: *The Land of the Negev*. Editors: A. Shmuelli, Y. Gradus. Tel-Aviv: Ministry of Defense Publishing House, 1979: pp. 666–672.

5 Forman, M.R., Hundt, G.L., Towne, D. *et al.* The forty day rest period and infant feeding practices among Negev Bedouin Arab women in Israel. *Medical Anthropology* 1990; **12**:207–216.

6 Lewando-Hundt, G. The exercise of power by Bedouin women in the Negev. In: *The Changing Bedouin*. Editors: E. Marx, A. Shmuelli. New Brunswick, NJ: Transaction Books, 1984; pp. 83–124.

7 Forman, M.R., Guptill, K., Chang, D. *et al.* Undernutrition among Bedouin Arab infants: the Bedouin infant feeding study. *American Journal of Clinical Nutrition* 1990; **51**:343–349.

8 Peto, R., Pike, M.C., Armitage, P. *et al.* Design and analysis of randomized clinical trials requiring prolonged observation of each patient II: analysis and examples. *British Journal of Cancer* 1977; **35**:1–39.

9 Butz, W., DaVanzo, J. *Determinants of breastfeeding and weaning patterns in Malaysia*. Washington DC: Rand Corp paper for the Agency for International Development, 1981.

10 Mott, S. The determinants of breastfeeding in Kenya. Unpublished report, 1982.
11 American Academy of Pediatrics, Committee on Nutrition. Encouraging breast-feeding. *Pediatrics* 1980; **65**:657–658.
12 WHO Working Group. Use and interpretation of anthropometric indicators of nutritional status. *Bulletin of the World Health Organization* 1986; **64**:929–941.
13 Cox, D.R. *The Analysis of Binary Data*. London: Methuen, 1970.
14 Dixon, W.J. (ed.) *BMDP Statistical Software*. Berkeley, California: University of California Press, 1985.
15 *SAS Users Guide: Basics Version* 5th edn. Cary, North Carolina: SAS Institute, 1985.
16 Harlap, S., Prywes, R., Grover, N.B. *et al.* Maternal, perinatal and infant health in Bedouin and Jews in southern Israel. *Israel Journal of Medical Sciences* 1977; **13**:514–528.
17 Forman, M. Review of research on the factors associated with choice and duration of infant-feeding in less developed countries. *Pediatrics* 1984; **74 (suppl.)**:667–694.
18 Akin, J., Belsborrow, R., Guilkey, D. *et al.* The determinants of breast-feeding in Sri Lanka. *Demography* 1981; **18**:287–307.
19 Akin, J., Belsborrow, R., Guilkey, D. *et al.* Breast-feeding patterns and determinants in Jordan. Presented at International Union for the Scientific Study of Population, Manila, December 1981.
20 Beaudry-Darisme, M. L., Hayes-Blend, L.C., Van Veen, A.G. The application of sociological research methods to food and nutrition problems on a Caribbean Island. *Ecology of Food and Nutrition* 1972; **1**:103–119.
21 Drejer, G.F. Bottle-feeding in Douala, Cameroon. *Journal of Tropical Pediatrics* 1980; **26**:31–36.
22 El-Mougi, M., Mostafa, S., Osman, N.H. *et al.* Social and medical factors affecting the duration of breast feeding in Egypt. *Journal of Tropical Pediatrics* 1981; **27**:5–11.
23 Jain, A.K., Bongaarts, J. Breastfeeding: patterns, correlates, and fertility effects. *Studies in Family Planning* 1981; **12**:79–99.
24 Knodel, J., Debavalya, N. Breastfeeding in Thailand: trends and differentials, 1969–79. *Studies in Family Planning* 1980; **11**:355–406.
25 Zurayk, H.C., Shedid, H.E. The trend away from breast feeding in a developing country: a woman's perspective. *Journal of Tropical Pediatrics* 1981; **27**:237–244.
26 Yagil, R., Amir, H., Abu-Rabiya, Y. *et al.* Dilution of milk. A physiological adaptation of mammals to water stress? *Journal of Arid Environments* 1986; **11**:243–247.
27 Martorell, R., Leslie, J., Moock, P.R. Characteristics and determinants of child nutritional status in Nepal. *American Journal of Clinical Nutrition* 1984; **39**:74–86.
28 Victora, C.G., Vaughan, J.P., Martines, J.C. *et al.* Is prolonged breast-feeding associated with malnutrition? *American Journal of Clinical Nutrition* 1984; **39**:307–311.